REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-11, 13-19, and 21-38 are currently pending. Claims 1, 10, 22, and 31 have been amended; and Claim 39 has been canceled without prejudice by the present amendment. The changes to the claims are supported by the originally filed specification and do not add new matter.

In the outstanding Office Action, Claims 1-11, 13-19, and 39 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,570,430 to Sheehan et al. (hereinafter "the '430 patent") in view of U.S. Patent Application Publication No. 2003/0215119 to Uppaluri et al. (hereinafter "the '119 application") in view of U.S. Patent Application Publication No. 2003/0152258 to Jabri et al. (hereinafter "the '258 application").

Applicants wish to thank the Examiner for the interview granted Applicants' representative on August 27, 2009, at which time a proposed amendment to the claims was discussed. In particular, Claims 1 and 14 were discussed. At the conclusion of the interview, the Examiner agreed to reconsider the rejections upon formal submission of a response to the outstanding Office Action.

Amended Claim is directed to a method, comprising:

> obtaining a temporal subtraction image of an anatomical region of a patient from two images taken at respective times separated by a time interval that is long enough to allow for pathological change in the anatomical region;
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> extracting at least one feature from the subtraction image;
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> determining whether a region of interest in the subtraction image includes an abnormality associated with said pathological change, based on the extracted at least one feature, wherein the determining step comprises distinguishing a region of pathologic change from regions with a motion or

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> misregistration artifact by inputting the at least one feature into
> an automated classifier; and
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> displaying a computer-aided diagnostic symbol
> indicating a location of a region representing said pathologic
> change on at least one of the temporal subtraction image and
> the two images.

The changes to Claim 1 are supported by the originally filed specification and do not add new matter.[1]

Applicants respectfully submit that the rejection of Claim 1 under 35 U.S.C. § 103(a) is rendered moot by the present amendment to that claim.

Regarding the rejection of Claim 1 under 35 U.S.C. §103(a), the Office Action asserts that the '430 patent discloses everything in Claim 1 with the exception distinguishing a region of pathological change from regions with a motion or misregistration artifact, and relies on the '119 and '258 applications to remedy that deficiency. However, it is unclear to Applicants how the three cited references are actually being applied to the rejection of independent Claim 1, as opposed to the rejection of independent Claim 14, which recites limitations different from those recited in Claim 1. In this regard, Applicants note that the Office Action appears to lump all of the limitations together, and applies the three references to all of the limitations. For example, the Office Action at the bottom of page 3 appears to rely on the teachings of the '258 application to disclose shift vectors, but Claim 1 does not recite shift vectors. Accordingly, it is unclear to Applicants whether the teachings of the '258 application are being applied in the rejection of Claim 1. Clarification is respectfully requested.

The '430 patent is directed to a method for automatically determining a contour of an internal organ based upon digital image data of a region in which the organ is disposed, the image data including a sequence of image frames of the region made over an interval of time

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[1] See, previous Claim 39 and page 16 of the originally filed specification.

in which a wall of the organ has completed at least one cycle of movement, wherein the wall of the organ undergoes repetitive cycles of movement as part of the organ's physiological function. In particular, the '430 patent discloses that the method includes developing an initial estimate of a region bounded by the contour of the organ in each image frame in the sequence by comparing the image data with parameters derived from training data that were previously produced through manual evaluation of a plurality of image frames of a corresponding cycle in other individuals, and using bounding motion data that was previously developed through manual evaluation of corresponding organs in other individuals to refine the initial estimate of the region in each image frame of the sequence to determine the contour. Further, the Background section of the '430 patent discloses that a technique that is sometimes employed to determine the contour of an organ is based on digital subtraction, noting that any part of the organ that does not move between the times the two images are made cannot be delineated. Thus, the '430 patent does not appear to use image subtraction as part of its inventive method.

However, as admitted in the outstanding Office Action, the '430 patent fails to disclose determining whether a region of interest in a subtraction image includes an abnormality associated with pathological change based on the extracted at least one feature, wherein the determining step comprises distinguishing a region of pathological change from regions with a motion or misregistration artifact. Further, Applicants respectfully submit that the '430 patent also fails to disclose distinguishing a region of pathological change from regions with the motion or misregistration artifact by inputting the at least one feature into an automated classifier, as recited in amended Claim 1.

Further, Applicants respectfully submit that the '430 patent fails to disclose obtaining a temporal subtraction image of an anatomical region of a patient from two images taken at respective times separated by a time interval that is long enough to allow for pathological

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change in the anatomical region, as required by Claim 1. While the Background section of

the '430 patent may disclose the concept of digital subtraction, the context of the Background

section as well as the disclosure of the '430 invention relates to determining a contour of a

left ventricle using a sequence of image frames taken during movement of the heart. Thus,

the '430 patent is directed to intervals of time related to physiological change, not

pathological change in an anatomical region, as required by Claim 1.

The '119 patent is directed to a method for computer-aided processing of dual or

multiple energy images including steps of obtaining a dual or multiple energy image data set,

defining a region of interest within an image from the dual or multiple energy image set,

extracting a set of feature measures from the region of interest, and reporting the feature

measures on the region of interest. As noted by the outstanding Office Action, Figure 2 of

the '119 application is directed to a flowchart of an image acquisition and processing method

that includes steps of image acquisition, pre-processing, decomposition, post-processing, and

presentation. Further, the '119 application discloses that the pre-processing step 20, which is

shown in detail in Figure 4, includes a registration/motion correction step 26. In particular,

the '119 application discloses that, in step 26, registration is performed to reduce motion

artifacts by correcting for motion and aligning anatomies between the high- and low-energy

images.[2] Further, paragraph [0025] of the '119 application discloses that, in the

decomposition step 30, edge information and/or artifact location information can be derived

from decomposed images for use in the registration/motion correction.

However, Applicants respectfully submit that the '119 application fails to disclose

determining whether region of interest in the subtraction image includes an abnormality

associated with pathological change, by distinguishing a region of pathological change from

regions with a motion or misregistration artifact by inputting the at least one feature into an

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[2] See paragraph [0024] of the '119 application.

automated classifier, as required by amended Claim 1. Applicants respectfully submit that the '119 application is silent regarding the use of the classifier recited in amended Claim 1. Rather, the '119 application merely discloses that registration between high- and low-energy images is performed to reduce motion artifacts, but is silent regarding any type of distinguishing between regions of pathological change and regions with artifacts by using an automated classifier, as required by Claim 1.

The '258 application is directed to a method of providing parameters for decomposing images from first and second energy images acquired from a digital radiography imaging system, including the steps of identifying energy levels from the first and second energy images, identifying a patient size being imaged by the digital radiography imaging system, identifying a filtration setting of a collimator for the digital radiography imaging system, obtaining a default decomposition parameter for the energy levels of the first and second energy images, and automatically providing a soft tissue decomposition parameter and a bone decomposition parameter by modifying the default decomposition parameter based on the patient size and the filtration setting.

However, Applicants respectfully submit that the '258 application fails to remedy the deficiencies of the '430 patent and the '119 application, as discussed above, with respect to the determining step recited in Claim 1. In particular, Applicants respectfully submit that the '258 application fails to disclose distinguishing a region of pathological change from regions with a motion or misregistration artifact by inputting the at least one feature into an automated classifier, as recited in amended Claim 1. In this regard, Applicants note that the Office Action does not clearly rely upon the teachings of the '258 application to disclose any of the limitations recited in Claim 1.

Further, Applicants note that the Office Action does not specifically address the classifier limitation recited in previous Claim 39.

Thus, no matter how the teachings of the '430 patent, the '119 application, and the '258 application are combined, the combination does not teach or suggest <u>determining whether a region of interest in a subtraction image includes an abnormality associated with the pathological change, based on the extracted at least one feature, wherein the determining step comprises distinguishing a region of pathological change from regions with a motion or misregistration artifact by inputting the at least one feature into an automated classifier</u>, as recited in amended Claim 1. Accordingly, Applicants respectfully submit that amended Claim 1 patentably defines over any proper combination of the cited references, and that the rejection is rendered moot by the present amendment to Claim 1.

Claim 14 is directed to a method, comprising: (1) obtaining a first dual-energy image, a first standard image, and one of a first bone image and a first soft tissue image from the first dual-energy image at a first point in time; (2) obtaining a second dual-energy image, a second standard image, and one of a second bone image and a second soft tissue image from the second dual-energy image at a second point in time; (3) using the first and second **standard** images to obtain shift vectors to obtain image registration; (4) performing temporal subtraction, using the shift vectors, <u>on one of the first and second bone images or one of the first and second soft tissue images</u> to produce a temporally subtracted image; and (5) outputting the temporally subtracted image.

Regarding the rejection of Claim 14 under 35 U.S.C. § 103(a), the Office Action appears to assert that the '430 patent discloses everything in Claim 14 with the exception of dual-energy bone/soft tissue methods and shift vectors, and relies on the '119 and '258 applications to remedy those deficiencies.

As discussed above, the '430 patent is directed to a method for automatically determining a contour of an internal organ based on digital image data of a region in which the organ is disposed.

However, as admitted in the outstanding Office Action, the '430 patent fails to disclose using first and second standard images to obtain shift vectors, and performing temporal subtraction using shift vectors, as recited in Claim 14.

As discussed above, the '119 application is directed to a method for computer-aided processing of dual or multiple energy images. As disclosed in Figures 5 and 6, the '119 application discloses a soft tissue image, a bone image, as well as low- and high-density images.

However, as admitted in the outstanding Office Action, the '119 application fails to disclose using first and second standard images to obtain shift vectors, and performing temporal subtraction, using the shift vectors, on one of the first and second bone images or one of the first and second soft tissue images to produce a temporally subtracted image, as recited in Claim 14.

As discussed above, the '258 application is directed to a method for providing parameters for decomposing images from first and second energy images acquired from a digital radiography imaging system. As noted by the outstanding Office Action, Figures 7 and 8 of the '258 application relate to a dual energy image acquisition system as well as an image registration process shown in step 316 and in more detail in Figure 8. However, as shown in Figure 7, the '258 application discloses a system in which the low-energy image and the high-energy image are first corrected to obtain images 312 and 314, and then image registration is performed to reduce motion artifacts between the low and high energy images in step 316. In particular, the '258 application discloses that ". . . the process 400 registers the low and high-energy images 302 and 304 by obtaining shift vectors of one image with respect to the other."[3] Further, the '258 application discloses that a warping transformation is then performed on the low energy image 302 to align anatomy with respect to the high energy

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[3] See paragraph [0042] of the '258 application.

image 304 **prior** to dual energy decomposition into soft tissue and bone images. Thus, the '258 patent discloses a registration process between the low and high-energy images prior to decomposition into soft tissue and bone images.

However, Applicants respectfully submit that the '258 application fails to disclose using the first and second **standard** images to obtain shift vectors to obtain image registration, and performing a temporal subtraction using the shift vectors on one of the first and second bone images or one of the first and second soft tissue images to produce a temporally subtracted image, as required by Claim 14. In this regard, Applicants note that Claim 14 recites a first dual energy image, a standard image, and one of a first bone image and a first soft tissue image, as well as a second dual energy image, a second standard image, and one of a second bone image and a second soft tissue image obtained from the second dual energy image at a second time point. Further, Applicants note that Claim 14 requires the comparison of the first and second standard images to obtain shift vectors, and then the application of those shift vectors to either the first and second bone images or the first and second soft tissue images to produce a subtracted image. On the contrary, the '258 system merely discloses registration between a low and high energy image prior to producing the soft tissue or bone images. Claim 14 requires obtaining shift vectors between first and second standard images, not high and low energy images. Moreover, the '258 application is silent regarding obtaining shift vectors from **one** set of images and applying the shift vectors to **another** set of images, as required by Claim 14. Rather, the '258 application discloses comparing two images for the purpose of registration, and applying the shift vectors obtained from that comparison to one of the two images.

Thus, no matter how the teachings of the '430 patent, the '119 application, and the '258 application are combined, the combination does not teach or suggest using first and second standard images to obtain shift vectors to obtain image registration, and performing
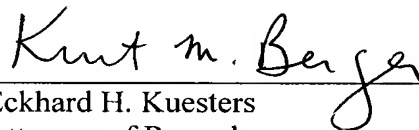
temporal subtraction, using the shift vectors, on one of the first and second bone images or one of the first and second soft tissue images, to produce a temporally subtracted image, as recited in Claim 14. Accordingly, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and that the rejection of Claim 14 (and all associated dependent claims) should be withdrawn.

Independent Claim 33 is directed to an apparatus that includes means for using the first and second standard images to obtain shift vectors, and means for performing temporal subtraction using the shift vectors. As discussed above, these limitations are not disclosed by any proper combination of the '430 patent, the '119 application, and the '258 application. Accordingly, for the reasons stated above, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and that the rejection of Claim 33 (and all associated dependent claims) should be withdrawn.

Consequently, in view of the present amendment and in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application as amended herewith is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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